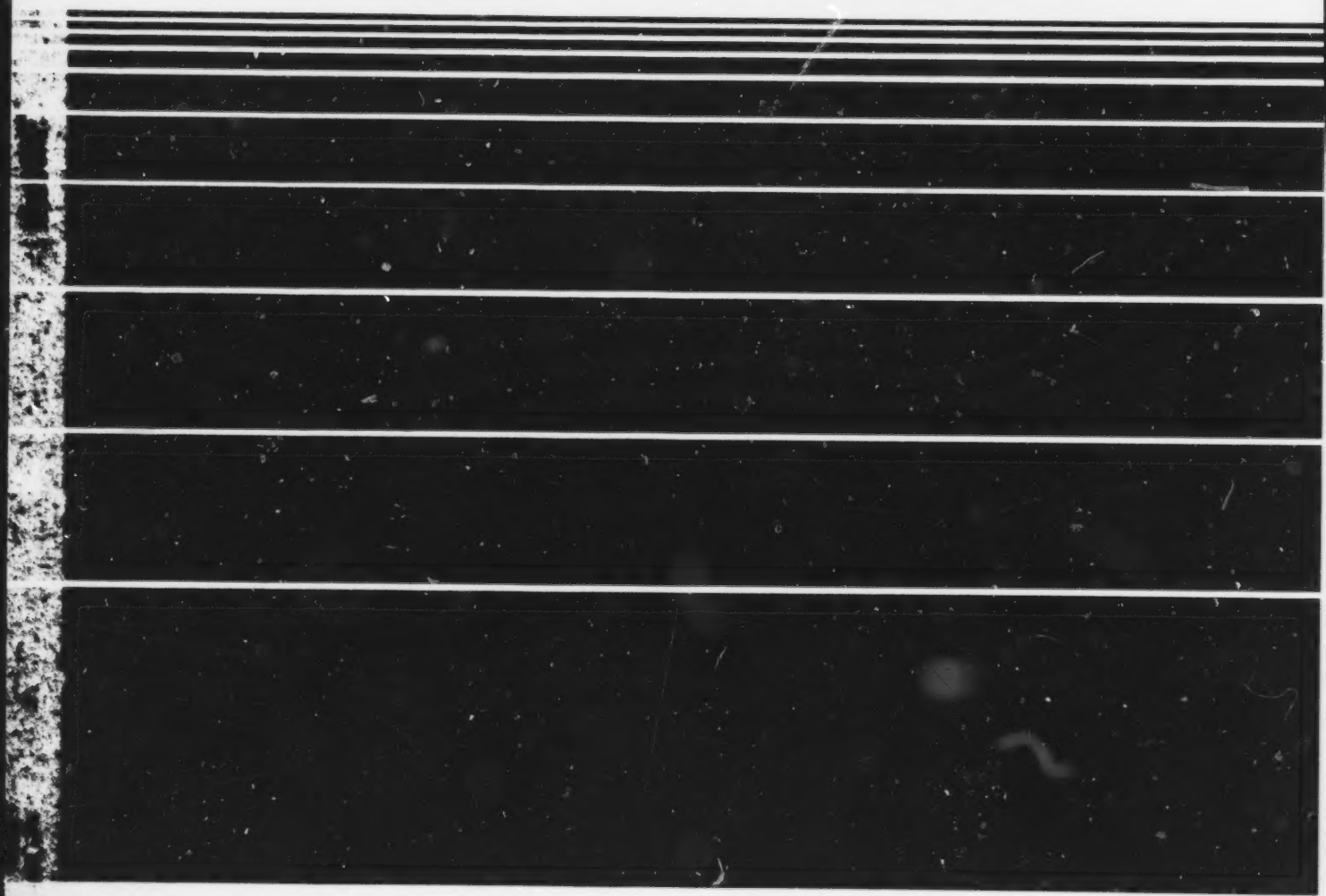

Manitoba
Environment
and Workplace
Safety and Health

MG-8159

MANITOBA NETWORK FOR PRECIPITATION COLLECTION (MNPC)

- AN OVERVIEW -

AIR STANDARDS AND STUDIES

ENVIRONMENTAL MANAGEMENT DIVISION

Report No. 85-07
OCTOBER 1985

ABSTRACT

Precipitation quality has been monitored in Manitoba through the Manitoba Network for Precipitation Collection program since the fall of 1980. The purpose of this monitoring programme is to provide information on deposition levels in support of the Province's efforts to assess the potential for damage to the Manitoba ecosystem by acidic deposition or "acid rain".

This report outlines, in brief, the establishment, objectives and operation of the M.N.P.C. network.

DISCLAIMER

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INTRODUCTION

The Environmental Management Division has monitored the quality of precipitation within the Province, since late 1980, under the Manitoba Network for Precipitation Collection Program or M.N.P.C. This program was initiated to assess the potential for damage to the ecosystem by the Long Range Transport of Air Pollutants or LRTAP. This phenomenon became amplified through industries' erection of "higher" smoke stacks in an attempt to alleviate localized pollution concerns. It is believed that the higher the smoke stack, the greater the ability to disperse emissions.

The initial two monitoring sites of the program, Island Lake and Norway House were located in areas predominantly downwind of the two nonferrous smelter operations in central Manitoba. These operations, Inco Ltd. located in Thompson and Hudson Bay Mining and Smelting Ltd. located in Flin Flon were the third and fourth ranked emitters of sulphur dioxide (SO_2) in Canada for the 1980 - 81 period, respectively with total combined emissions of approximately 403,000 tonnes.[1] Specific standardized criteria for the establishment of precipitation quality sites were not fully developed at the time the program began in Manitoba. However, the M.N.P.C. program followed the examples of other jurisdictions in choosing the sampling locations.

This document provides the reader with an overview of the M.N.P.C. program. Specific sections dealing with siting criteria, program objectives and descriptions of the areas under investigation are included.

BACKGROUND

Acidic deposition encompasses both the "wet" and "dry" processes which scavenge pollutants from the atmosphere. The "wet" component refers to all forms of precipitation (rain, snow, sleet, fog, etc.) while the "dry" component refers to the deposition of aerosols, gases, and particulate directly to the ecosystems.

"Normal" precipitation is slightly acidic, a result of the combination of naturally occurring carbon dioxide gas (CO_2) and water vapour (H_2O). The combination of these two elements forms carbonic acid (H_2CO_3), a weak acid. The pH of this precipitation can be as low as 5.6. Precipitation with pH values lower than 5.6, is generally considered acidic precipitation. Ecosystems which have insufficient or limited buffering capacities are more easily effected from exposure to acidic precipitation. Damage to buildings, and effects to human health are other related problems.

It is suspected that the acidity of precipitation with pH values lower than 5.6 is caused mainly by anthropogenic emissions of sulphur dioxide (SO_2) and oxides of nitrogen (NO_x). Natural phenomena such as volcanic activity, forest fires and natural decomposition of organic matter also contribute sulphur dioxide to the atmosphere, but, at a lower level than man.

The major anthropogenic emitters of sulphur dioxide and oxides of nitrogen in Manitoba are the nonferrous smelting industry and transportation, respectively. Pulp and paper industries (Manfor, the Pas and Abitibi-Price, Pine Falls) and thermal generating plants utilizing fossil fuels (Manitoba Hydro, Brandon and Selkirk) are also sources of these pollutants.

Monitoring in Manitoba

The quality of precipitation within the province has been monitored prior to 1980. In 1977, the Federal Atmospheric Environment Service (A.E.S.) established the Canadian Network for Sampling Precipitation or CANSAP. In Manitoba it consisted of four monitoring sites namely: Churchill, The Pas, Dauphin and Bissett. These four sites were part of the Canada wide precipitation network. The sampling equipment utilized in Manitoba were automatic Sangamo type precipitation collectors. These samplers were automatically energized by the onset of a precipitation event. Composite samples were collected over a 30 day period prior to analysis. The samplers were typically located at or near an airport facility.

In-depth studies of the acidic precipitation phenomenon, revealed that many external factors could affect the chemical integrity of the collected samples. One such factor was the sampler's proximity to air traffic. In order to make the monitoring more effective the CANSAP network underwent an intensive review in the summer of 1982 and the Canadian Air and Precipitation Monitoring Network, (CAPMON), was developed. Of the four previously mentioned Manitoba CANSAP locations, two (Churchill and The Pas) were judged unsuitable and deleted from the program and the remaining two, (Bissett and Dauphin) were relocated to Island Lake and McCreary respectively.[2]

As previously mentioned, the M.N.P.C. program began monitoring precipitation quality in the fall of 1980. Norway House and Island Lake were the sites chosen at that time without the

availability of specific siting criteria. However, in the summer of 1982 it was realized that these sites were not providing a comprehensive overview of precipitation quality throughout the Province. In addition, publications and research had, by this point provided comprehensive guidelines, (in the form of specific criteria) for the establishment of a precipitation monitoring site. These two facts, were taken into consideration during the expansion of the M.N.P.C. network, in the fall of 1982. The existing Norway House location, at the airport, was abandoned and a more desirable location chosen on an island in the same region. The Island Lake location required no changes. This station was subsequently collocated with the Federal (CAPMON) network station for quality assurance purposes between the two networks. Numerous communities were visited and evaluated with the new siting criteria in mind. Brochet, Gillam, and Pointe du Bois were finally chosen as additional sites for the network. A map illustrating the monitoring networks in Manitoba is presented in Appendix C.

Program Objectives

The objectives of the M.N.P.C. Program are:

1) to provide sufficient base data to determine precipitation quality with emphasis on acidic substances;
2) to attempt to categorize the acidification within the Province into two broad categories, namely, imported and domestic, focusing on the potential for the exacerbation of imported acidification by input from domestic anthropogenic sources, and;

3) to offer verifiable precipitation chemistry data to outside jurisdictions.

To meet these objectives the M.N.P.C. program has been designed as follows:

1) sample collectors have been located in regions exempt from large point source emitters.
2) sample collectors have been located in areas deemed sensitive to acidic deposition.
3) sample collection will be conducted on a daily (24 hr.) basis. Several "events" may occur in a 24 hour period but the collected composite sample is designated as a single 24 hour sample.

Selection Criteria

The current sites of the M.N.P.C. program have been selected on the basis of Neil R. McQuaker's, report.[3]

The guidelines are as follows:

1. Within 50 km of the sampler there should be no anthropogenic emission sources which could effect precipitation chemistry. Sources greater than 50 km from the site are considered to exert a regional influence.
2) Within 1.0 km of the sampler there should be:
   a) minimal and preferably no moving sources of pollution such as air, water and surface transportation.
   b) no surface storage sources of pollution such as sewage plants and
   c) no wind activated sources of pollution such as cultivated fields and areas of no vegetation.

3. The distance between the sampler and nearby furnace or incinerator flues should be sufficient that emissions do not affect the chemistry of the collected sample. A horizontal separation between the flue exit and samplers of at least 100 metres is recommended.
4. Within 5 metres of the sampler there should be no object above the height of the sampler.
5. No object should be closer to the sampler than a distance of 2.5 times the height the object extends above the sampler.
6. Sampler intake should be located 1-2 metres above height of existing ground cover.

Sampling Site Information

Each monitoring site is unique in its combination of topographical and climatological conditions. The "McQuaker" Report, in addition to presenting recommendations for siting criteria, also presented recommendations with respect to the documentation of a monitoring site once it has been established. These recommendations were also adopted by the M.N.P.C. program as stated:

1. Universal Transverse Mercator grid Coordinates.
2. Elevation of sampler above sea level.
3. Height of sampler intake above ground cover.
4. Distance of sampler from obstructions and heights of obstructions.
5. Distance of sampler from sources (stationary and mobile).

6. Site photographs to consist of 5 photos: one in each cardinal direction looking out from sampler and one close-up of sampler. Ground cover should be included in the close-up photograph.

In view of the remoteness of the individual monitoring sites some variations and compromises from the above recommendations have been made. Each monitoring site is unique with respect to topography, and degrees of isolation. Brochet, for example, is extremely isolated in terms of accessibility and more so in terms of communication links. On the other hand, Pointe du Bois is easily accessible through all seasons with no difficulty in communications. The remaining stations fall between these extremes leaning towards the Pointe du Bois side.

Appendix B provides information of a preliminary evaluation of each station. From Appendix B it can be seen that the most prevalent variation for all sites is the proximity to a travelled roadway. In all but one station, Norway House, the samplers are located within the 1.0 kilometre restriction. Two of these roadways, located in Gillam and Pointe du Bois, are access roads to other facilities within the complex, while the remaining two roadways, Brochet and Island Lake, are major community roads. The volume of traffic utilizing these "major" roads is minimal when compared to any roadway in an urban setting.

Another situation, that is unique to Norway House, is the possibility of "canopy" effects caused by the restricted size of the clearing in which the sampler is located. Speculation is that the mature coniferous trees (>15m high) surrounding the clearing are

influencing the amount and possibly the integrity of the collected samples. To date an investigation of this has not been pursued.

The following brief description of each monitoring station provides an insight into the region(s) under investigation:

Norway House

Lat. 54°00'N., Long. 97°48'W., Elev. 217 m. Universal transverse Mercator Grid coordinates (U.T.M.G.) NQ 5775984.

The community of Norway House is located on the east channel of the Nelson River approximately twenty-nine kilometres north of Lake Winnipeg.[4] Situated one hundred and ninety kilometres south of the Thompson smelter and two hundred and seventy-five kilometres east southeast of the Flin Flon smelter, the community had a population of two thousand eight hundred and thirty-four in 1983.[4] Commercial fishing and trapping are the principal economic activities.

The climatic conditions of the Norway House area fall into the general category of continental subarctic[5] characterized by annual extremes in temperature and short cool summers. The total average annual precipitation is 441 mm.[6] The predominant wind direction is north northwest at an average velocity of 15.5 k.p.h. Appendix A presents "wind rose" values averaged over the period 1973 to 1980.[7]

Surficial geology of this region is proglacial and glacial characterized by deep basin deposits of silt, clay, sand and minor gravel, 1 to 30 m thick.[8]

Island Lake

Lat. 53°52'N., Long. 94°40'W., Elev. 238 m. U.T.M.G. UK 3904693.

The Island Lake community is comprised of several islands located on Island Lake, approximately three hundred kilometres southeast of the smelter operation in Thompson and four hundred and seventy-five kilometres east southeast of the Flin Flon operation. Fishing and trapping are the major economic activities of Island Lake. The monitoring equipment is located on Stevenson Island, a subcommunity with a population of approximately one hundred and five (1983).[4]

Climatically, the Island Lake region is also considered to be continental to subarctic.[5] Annual average total precipitation for the area is 567 mm.[6] The predominant wind direction is northwest at an average velocity of 13.9 k.p.h.[7] Appendix A presents "wind rose" values for this region.

Glacio-lacustrine deposits, 1 to 30 m thick comprised of silt, sand and minor gravel constitute the surficial geology of this region.[8]

Brochet

Lat. 47°54'N., Long. 101°41'W., Elev. 343 m

U.T.M.G. LV 3426419.

The village of Brochet is located on the north shore of Reindeer Lake approximately three hundred and twenty-five kilometres north northwest of the smelter operation in Thompson and three hundred and fifty kilometres north of the smelter in Flin Flon. The

community, located on the Barrenlands Indian Reserve (IR197) had a population of two hundred and forty-one as of 1982.[9] The major economic activities are fishing and trapping.

Climatically, Brochet is located in a region classified as continental subarctic characterized by large yearly temperature variations. Cold, snowy climate with cool short summers characterize this classification.

The average annual total precipitation is 427 mm [6] with a predominant wind direction from the northwest at an average velocity of 16 k.p.h. Appendix A presents "wind rose" values for this region.[7]

The surficial geology of the area has been characterized as moderately calcareous till, one to ten metres thick derived primarily from mesozoic shales. A typical composition contains 13% gravel, 33% sand, 31% silt and 23% clay with small bedrock outcrops.[8]

Gillam

Latitude 56°21'N Longitude 94°40'W Elevation 138 m.

U.T.M.G. VM 4004467.

The community of Gillam is located on the Nelson River, approximately 200 kilometres east northeast of the smelter operation in Thompson and 357 kilometres northeast of the operation in Flin Flon. The population of the community was 1763 in 1979.[10] Major economic activities of the community are mainly in conjunction with the Manitoba Hydro, (hydroelectric) generating station at Kettle Rapids approximately 10 km away.

Climatically, Gillam is in an area generally known as a continental subarctic climate characterized by large annual temperature ranges. [11] The annual average precipitation for the Gillam area is 484 mm [6] with a predominant wind direction from the northeast at an average velocity of 16.8 k.p.h.[7] Appendix A presents "wind rose" values for the Gillam area.

The surficial geology of this region is classified as a Pro glacial environment consisting of Glacio fluvial deposits. These deposits are comprised in part of sand, gravel and silt, 1-100 m in depth deposited in an ice marginal environment.[8]

Pointe du Bois

Latitude 50°18'N Longitude 95°33'W Elevation 298 m.

U.T.M.G. UF 3185575

The village of Pointe du Bois is located in the Whiteshell Provincial Park approximately 54 kilometres southeast of the pulp and paper industry in Pine Falls and 120 kilometres northeast of the City of Winnipeg. The smelting operations in Thompson and Flin Flon are 583 kilometres north northwest and 616 kilometres northwest respectively. The main employer in Pointe du Bois is Winnipeg Hydro, at the hydro electric generating dam. There is no agricultural activity within 30 kilometres of this village.

Climatically, the Pointe du Bois area receives an average annual precipitation of 516 mm.[12] No data base is available from this station regarding wind speed or direction.

The surficial geology of the region is a non glacial, precambrian bedrock environment, composed of Paleozoic and Mesozoic bedrock of various lithologies and variable topography.[8]

Field Measurements

Field Operations

The MNPC samplers are Meteorological Instruments Corporation (M.I.C.) Type A-1 automated precipitation collectors. Though constructed for catching both "wet" and "dry" components, sampling is performed for wet fall only. These samplers consist of two buckets with a moveable lid which is tripped at the commencement of a precipitation event to expose the bucket for collection of fall. During non-precipitation times, the wet collection bucket is covered. The samplers have also been retrofitted to improve operational longevity and to maintain operation during extreme cold.

Samples are collected in polyethylene bags on a twenty-four hour basis commencing each day at 0800 hrs. (L.S.T.). Detailed procedures [13] have been formulated for field operators which describe the methodology and techniques to be followed in handling empty bags, samples, etc.

On site refrigeration prior to weekly shipment of samples from site to the W. M. Ward Technical Services Laboratory in Winnipeg for analysis is also provided. At each site, beside the automated precipitation collectors, there is associated equipment (standard rain gauge and at some sites Nipher snow guages) to accurately measure the quantity of all forms of precipitation fall.

Field operations at each site are performed by residents of that Community through arrangements with the Department (except for Island Lake where the site is operated as part of an Environment Canada surface weather station). However, each site is visited regularly by program technical staff who also maintain a continuing liaison with operators to ensure integrity of field operations.

Timetable of Operation

The coordination of operations between the field and the Technical Services Laboratory is essential to minimize chemical deterioration of the collected sample caused by excessive transportation and handling delays. To this end, the sampling stations ship their samples on a staggered basis. This procedure attempts to have all samples arrive for analysis within one or two days of each other. Various modes of transportation are utilized, the primary being air cargo. Once received by the laboratory the samples are refrigerated and subsequently analysed. The turn around time is approximately 10 to 14 working days.

Sample Handling

The M.N.P.C. network incorporated the use of polyethylene bags for sample collection late in 1983. This method, has streamlined sample handling and also "matched" the collection method utilized by the Federal CAPMON network. Once a sample has been collected, the bag is heat sealed and refrigerated on site until shipment. The shipping containers currently in use are insulated mailing tubes constructed of rigid material which protects the contents. These "mailers" are supplied to each station on an "as needed" basis. No study has been instituted to determine how well or poorly these mailers maintain the temperature of the sample during shipment. There exists a possibility that insulated coolers with ice packs may have to be instituted for the summer months.

Analytical Priorities

A protocol exists within the laboratory to ensure maximum utilization of the samples received. This protocol is volume dependent. If a sample volume is greater than 50 mL the analysis is as follows: 1) pH, 2) acidity, 3) conductance, 4) sulphate, 5) nitrate, 6) ammonia, 7) calcium, 8) magnesium, 9) potassium, and 10) sodium. The order indicates priority. If a sample is received whose volume is less than 50 mL no analysis is performed, however, the event is recorded as a trace event for later data interpretation. It is hoped that even with this apparent restriction, that in any given month we will be able to analyze an amount of precipitation (made up of various samples) which will represent more than half of the precipitation which fell. If this is not the case, ie. if collection efficiency (for the month) is less than 50% it would be difficult to make or justify accurate inferences from the data.

Quality Assurance (Field)

The standardization of the field sampling network is a major concern of the M.N.P.C. program. To provide a degree of similarity in sample collection techniques the network utilizies five modified M.I.C. type A-1 automated precipitation collectors. The modifications were made to the electrical and mechanical systems to provide more reliable operation. Each non divisional operator was provided with a manual (field) outlining sample collection procedures as well as being involved in a "hands on" demonstration. It was also realized that although compatibility may exist between the five monitoring stations

within the network, compatability may not exist between the M.N.P.C. network and networks of other jurisdictions, for example CAPMON. The M.N.P.C. program incorporated the use of polyethylene bags late in 1983, which parallel the newly formed CAPMON network collection method. To provide comparability between M.N.P.C. and the CAPMON programs, one of the M.N.P.C. locations, Island Lake, is collocated with the CAPMON network. Collocation provides the ability to assess equipment performance and operator reliability through duplicate sample collection.

B. Laboratory

Quality assurance programs (QA) within the laboratory related to the M.N.P.C. program are extensive and provide a degree of verification of analysed data. In brief, the QA programs utilized by the laboratory for the M.N.P.C. program are:

- systematic analysis on each lot of polyethylene bags prior to shipment into the field.
- sample splitting in situations of large sample volumes.
- composite sample storage for field to laboratory "blind" samples.
- analysis of LRTAP samples for inter-laboratory comparison.

DATA HANDLING

The analytical data received from the laboratory is handled in several different aspects:

1. The data is tabulated, by monitoring station, directly onto the field operators log sheet.

2. The data from each station is tabulated onto "raw" data sheets and also archived on Data Base Management System (Focus).
3. Specific data results (i.e. weighted mean pH, $SO_4^=$, NO_3^- and a moving yearly wet $SO_4^=$ deposition) are tabulated for each station monthly in an internal ambient air quality summary.
4. A report summarizing all aspects of the program is presented yearly. The possibility exists for other types of reports; i.e.; 1) a multi year (2 or more) summary and 2) "ad hoc" summary (history) as required.

It is envisioned, in the future, that air mass trajectory programs to delineate specific information with respect to chemical influences on air parcels passing over or nearby the smelter operations may also be incorporated into the data handling.

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APPENDIX A.

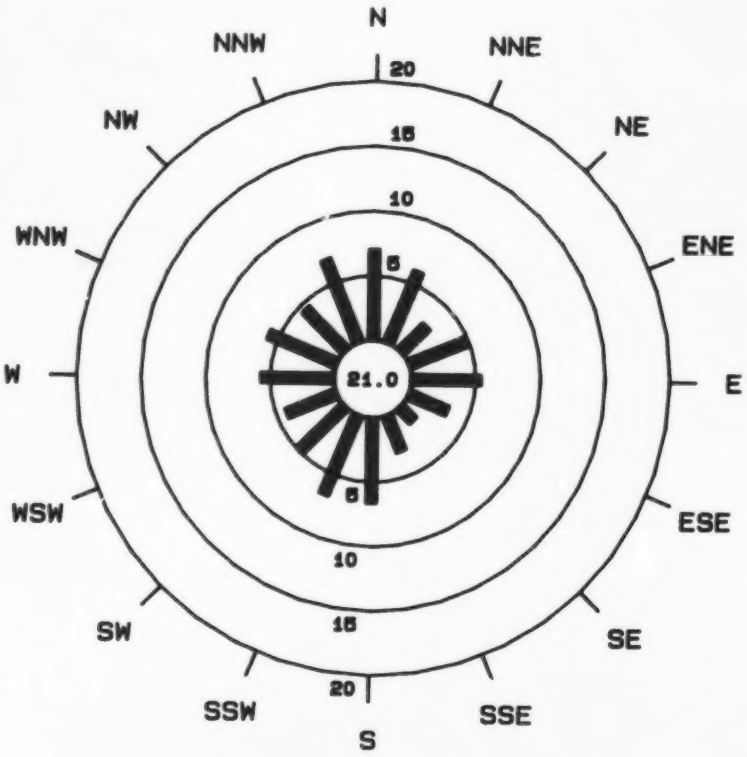
WIND ROSE VALUES -

MNPC MONITORING STATIONS

NORWAY HOUSE A

	SPEED (km/h)	PERCENT FREQ'CY
N	14.8	7.0
NNE	14.5	8.0
NE	14.1	2.8
ENE	14.1	4.9
E	13.4	5.4
ESE	12.7	3.3
SE	12.7	1.5
SSE	13.1	3.0
S	15.5	6.6
SSW	16.8	6.7
SW	15.4	4.7
WSW	14.5	4.2
W	14.4	5.7
WNW	15.8	5.8
NW	15.8	4.5
NNW	15.5	6.9
CALM		21.0
ALL	11.8	

PERIOD OF RECORD: 1973-1980



ANNUAL

WIND ROSE

FREQUENCY BY DIRECTION - %

CANADIAN CLIMATE NORMALS

VOLUME 5 : WIND (1951-1980)

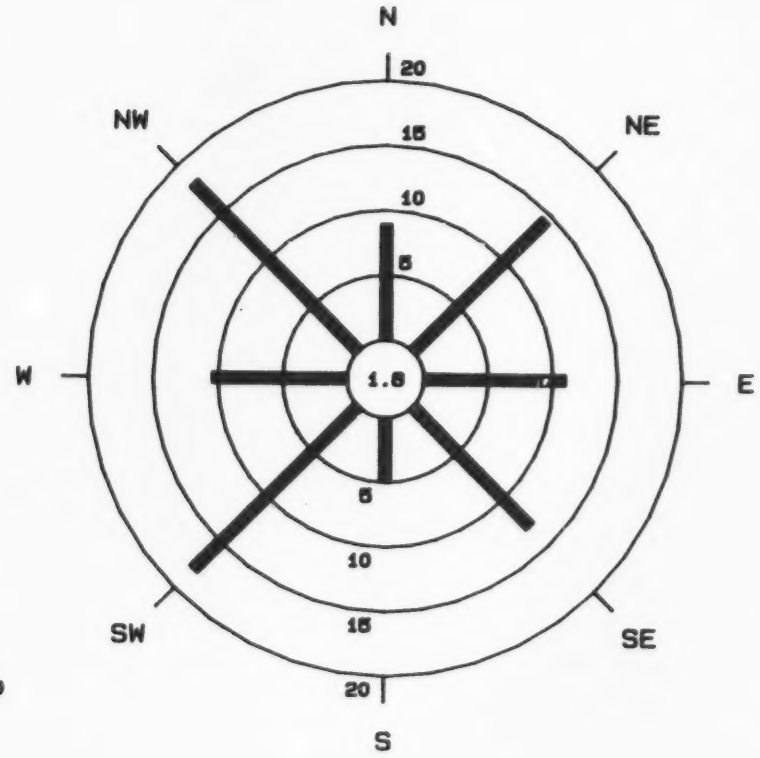
COMPUTER GRAPHICS PRODUCT -

SSD WINNIPEG

ISLAND LAKE

	SPEED (km/h)	PERCENT FREQ'CY
N	12.3	8.9
NE	14.5	14.4
E	12.0	10.9
SE	11.1	12.9
S	8.9	4.9
SW	12.1	17.8
W	8.3	10.4
NW	13.9	18.1
CALM		1.8
ALL	12.0	

PERIOD OF RECORD: 1970-1980



ANNUAL

WIND ROSE

FREQUENCY BY DIRECTION - %

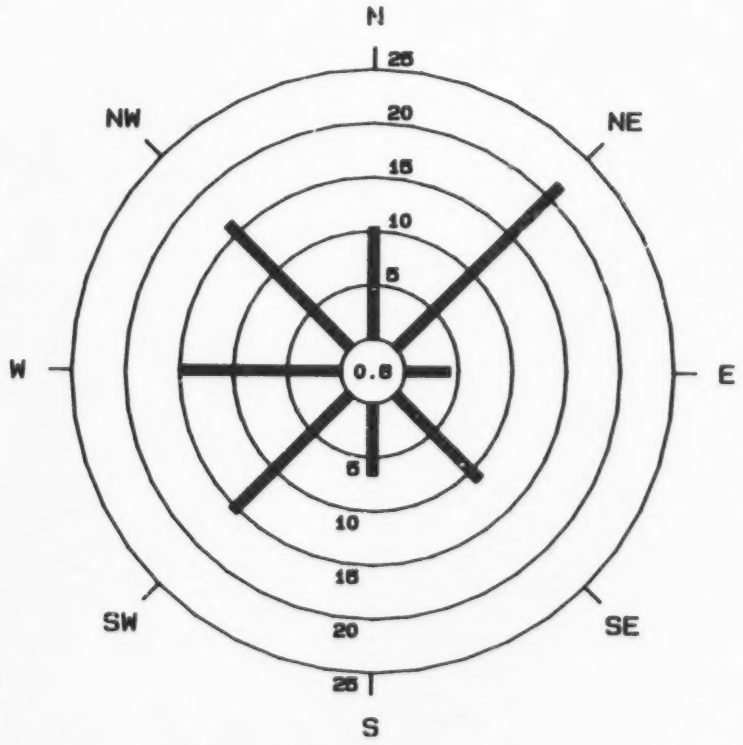
CANADIAN CLIMATE NORMALS
VOLUME 6 : WIND (1951-1980)

COMPUTER GRAPHICS PRODUCT -
SSD WINNIPEG

GILLAM A

	SPEED (km/h)	PERCENT FREQ'CY
N	17.7	10.8
NE	18.8	21.4
E	8.3	4.1
SE	11.4	11.0
S	11.8	8.8
SW	15.0	15.3
W	18.8	14.8
NW	19.0	18.1
CALM		0.8
ALL	15.7	

PERIOD OF RECORD: 1970-1980



ANNUAL

WIND ROSE

FREQUENCY BY DIRECTION - %

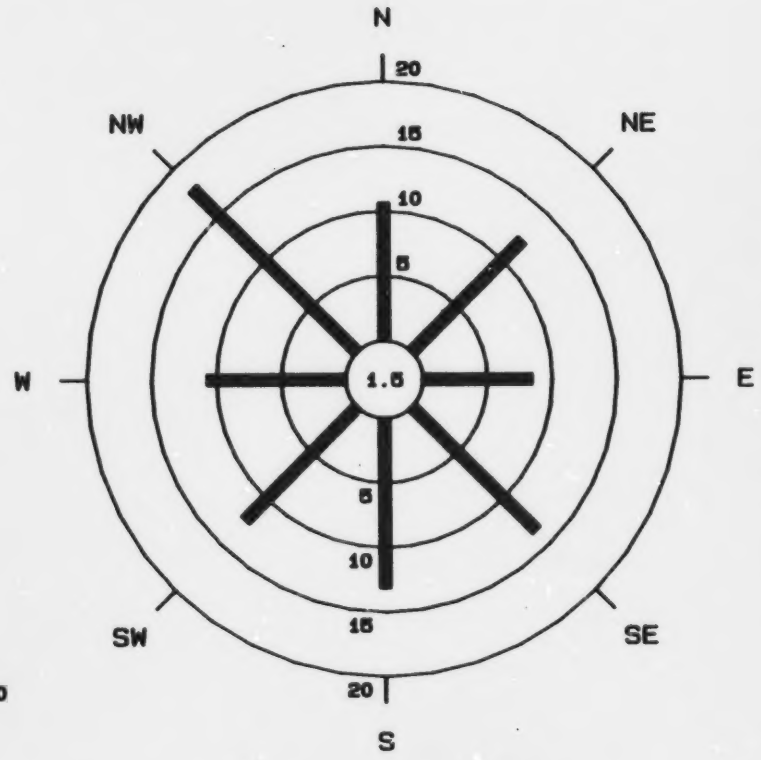
CANADIAN CLIMATE NORMALS
VOLUME 6 : WIND (1951-1980)

COMPUTER GRAPHICS PRODUCT -
SSD WINNIPEG

BROCHET A

	SPEED (km/h)	PERCENT FREQ'CY
N	13.2	10.6
NE	14.4	12.1
E	13.6	6.4
SE	15.7	13.5
S	12.5	13.1
SW	13.2	12.3
W	12.3	10.7
NW	16.0	17.8
CALM		1.5
ALL	13.9	

PERIOD OF RECORD: 1966-1980



ANNUAL

WIND ROSE

FREQUENCY BY DIRECTION - %

CANADIAN CLIMATE NORMALS

VOLUME 5 : WIND (1951-1980)

COMPUTER GRAPHICS PRODUCT -

SSD WINNIPEG

APPENDIX B.

PRELIMINARY MONITORING SITE EVALUATION - M.N.P.C.

PRECIPITATION MONITORING PROGRAM
PRELIMINARY SITE EVALUATION

LOCATION: NORWAY HOUSE FORESTRY IS.

DATE: NOVEMBER 26/82

SITING CRITERIA REQUIREMENT #	SITE MEETS	VARIATIONS	COMMENTS
1.	X		no forms of industrial pollution
2.A	X		not on flight path of airport
2.B	X		no sewage storage
2.C	X		operator has veg. garden and flower garden, pollen etc. may pose problem
3.	X		more than 100 m. from operators home (WOODSTOVE in home)
4.	X	X	knipher gauage (existing) approx. 3.0 m. away
5.		X?	clearing possibly insufficient, a coniferous tree (MATURE)
6.	X		approx. 1.0 m above ground

PRECIPITATION MONITORING PROGRAM
PRELIMINARY SITE EVALUATION

LOCATION: ISLAND LAKE, AES WEATHER STATION

DATE: NOVEMBER 26/82

SITING CRITERIA REQUIREMENT #	SITE MEETS	VARIATIONS	COMMENTS
1.	X		no visible form of industralization
2.A	X		the airport is located approximately 1.8 km away
		X	roadway approx. .2 km away, sheltered by coniferous trees
		X	shore of lake approx. .2 km away
2.B	X		no sewage plants in area
2.C	X		no agricultural activity in area, (operator has small veg. garden)
3.		X	weather office 46 m away, oil heated
4.	X	X	highest closest object, Stephenson guages 7 m away
5.	X		
6.	X		approx. 1.0 m. off ground

PRECIPITATION MONITORING PROGRAM
PRELIMINARY SITE EVALUATION

LOCATION: BROCHET

DATE: FEBRUARY 23/83

SITING CRITERIA REQUIREMENT #	SITE MEETS	VARIATIONS	COMMENTS
1.	X		no industrial activity in area
2.A	X	X	within 1.0 km is road to airport and runway. (sheltered by mature trees)
B	X		sewage lagoon approx. 2.0 km away
C	X		no agricultural activity
3.	X		homes approx. 200 m away
4.	X		low shrubs and lichens (stunted trees approx. 50 m away)
5.	X		no obstructions
6.	X		approx. 1.0 m above ground

PRECIPITATION MONITORING PROGRAM
PRELIMINARY SITE EVALUATION

LOCATION: GILLAM, RADISSON CONVERTOR STATION

DATE: JANUARY 83'

SITING CRITERIA REQUIREMENT #	SITE MEETS	VARIATIONS	COMMENTS
1.	X		no industrial emissions
2.A	X	X?	not on flight path, access road to pumphouse (seldom travlled)
B	X		no on site sewage storage
C	X	X?	no agricultural activity, ground mostly sand gravel etc.
3.	X		no emissions from converter station
4.	X		low ground cover (brush) approx. 30 m away
5.	X		
6.	X		approx. 1.0 m above ground

PRECIPITATION MONITORING PROGRAM
PRELIMINARY SITE EVALUATION

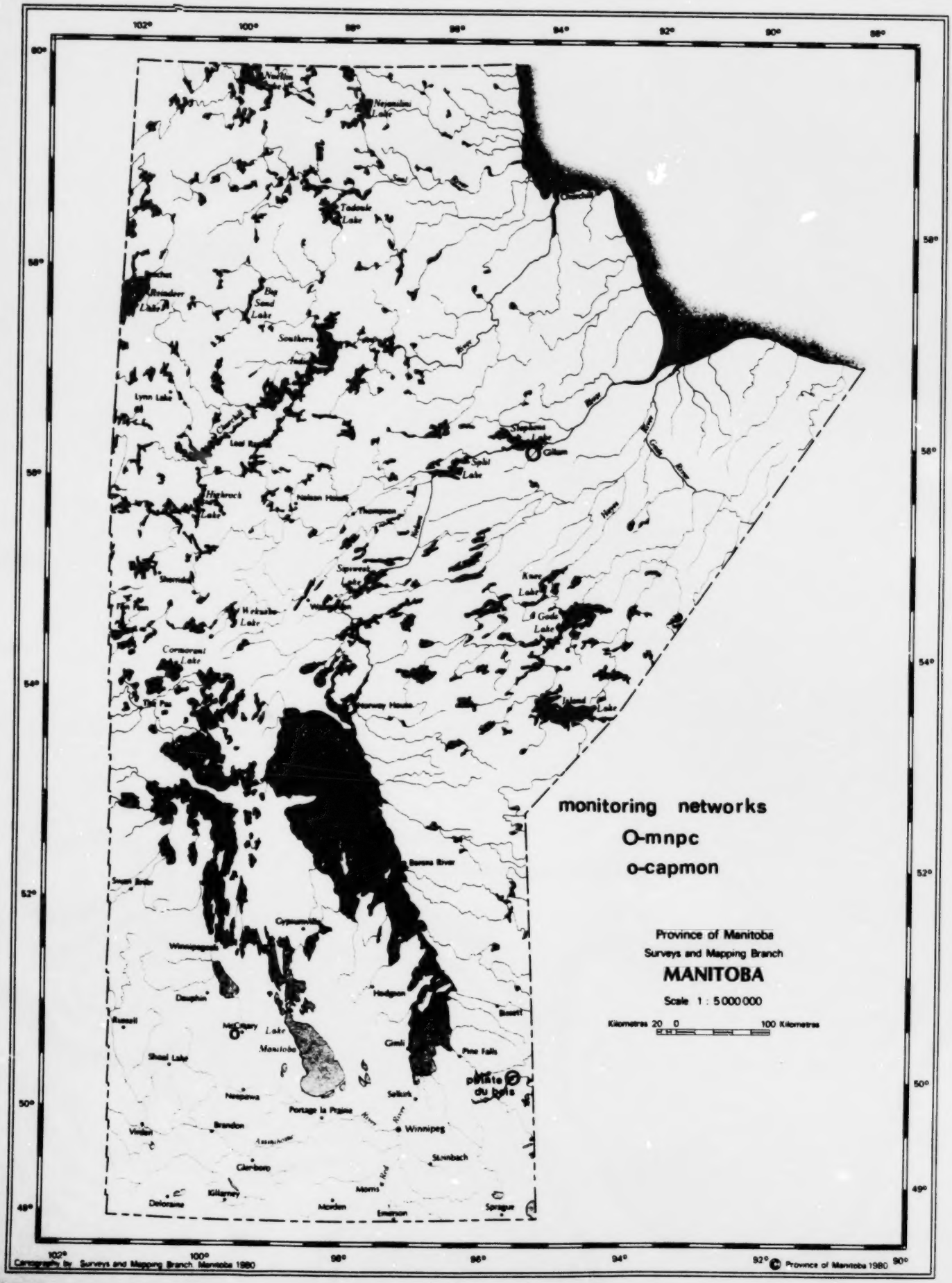
LOCATION: POINTE DU BOIS, DAM SITE

DATE: FEBRUARY 83'

SITING CRITERIA REQUIREMENT #	SITE MEETS	VARIATIONS	COMMENTS
1.	X		no industrial activity
2.A	X	X?	lake shore approx. 30 m away, no major traffic (boat), road to meter house
B	X		no sewage plants in area
C	X		no agricultural activity in area
3.	X		homes etc. heated electrically
4.	X		trees etc. approx. 7 m from sampler
5.	X		
6.			approx. 2.0 m above ground cover

APPENDIX C.

MAP OF MONITORING NETWORKS IN MANITOBA


monitoring networks
O-mnpc
o-capmon
Province of Manitoba
Surveys and Mapping Branch
MANITOBA
Scale 1 : 5 000 000
Kilometres 20 0 100 Kilometres
Cartography by Surveys and Mapping Branch Manitoba 1980
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